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THE MORAY EELS (PISCES: MURAENIDAE) OF
THE GALAPAGOS ISLANDS, WITH NEW
RECORDS AND SYNONYMIES OF
EXTRALIMITAL SPECIES

By

John E. McCosker

*Steinhart Aquarium, California Academy of Sciences,
Golden Gate Park, San Francisco, California 94118*

and

Richard H. Rosenblatt

*Scripps Institution of Oceanography, University of
California, San Diego, La Jolla, California 92037*

ABSTRACT: Sixteen species of muraenid eels are recognized from the Galapagos Islands. These are (new records in boldface): *Anarchias galapagensis* (Seale), *Echidna nocturna* (Cope), *E. zebra* (Shaw), *Gymnothorax dovii* (Günther), *G. buroensis* (Bleeker), *G. castaneus* Jordan and Gilbert, *G. panamensis* (Steindachner), *G. pictus* (Ahl), *Enchelycore octaviana* (Myers & Wade), *E. lichenosa* (Jordan & Snyder), *Muraena lentiginosa* Jenyns, *M. clepsydra* Gilbert, *M. argus* (Steindachner), *Uropterygius polystictus* Myers & Wade, *U. necturus* (Jordan & Gilbert), and an undescribed species of *Uropterygius*. The following new synonymies are proposed: *Rabula* Jordan & Davis, 1891 = *Gymnothorax* Bloch, 1795. *Rabula davisii* Fowler, 1912 = *Gymnothorax mordax* (Ayres, 1859). *Sideria chlevastes* Jordan & Gilbert, 1883 = *Gymnothorax rueppelliae* (McClelland, 1845). *Echidna scabra* Garman, 1899; *E. chionostigma* Fowler, 1912; *Muraena acutis* Seale, 1917; and *Rabula rotchii* Clark, 1936 = *Echidna nocturna* (Cope, 1872). *Gymnothorax arae* Borodin, 1928 = *G. dovii* (Günther, 1870). *Gymnothorax thomsoni* Borodin, 1928 = *G. pictus* (Ahl, 1870). *Murenophis marmoreus* Valenciennes, 1855; *Muraena aquae-dulcis* Cope, 1872; *M. insularum* Jordan and Davis, 1891; and *Lycodontis xanthospilus* Fowler, 1944 = *Muraena lentiginosa* Jenyns, 1842. *Muraena albigutta* Hildebrand, 1946 = *M. argus* (Steindachner, 1870).

INTRODUCTION

The Galapagos Islands (Archipiélago de Colón) possess a large and diverse marine eel fauna, many species of which are muraenids. The moray fauna of the islands has not been treated as a whole since Jordan and Evermann (1896). We herein provide a listing of the 16 valid species, the first records of seven additional species, and comments on the validity of several Galapagos and extralimital nominal species of morays. A key is provided for the identification of known Galapagos species.

The following list includes those species whose existence at the Galapagos we have verified: *Anarchias galapagensis* (Seale), *Echidna nocturna* (Cope), *Gymnothorax dovii* (Günther), *G. buroensis* (Bleeker), *G. castaneus* Jordan & Gilbert, *G. panamensis* (Steindachner), *G. pictus* (Ahl), *Enchelycore octaviana* (Myers & Wade), *E. lichenosa* (Jordan & Snyder), *Muraena lentiginosa* Jenyns, *M. clepsydra* Gilbert, *M. argus* (Steindachner), *Uropterygius polystictus* Myers & Wade, *U. necturus* (Jordan & Gilbert), and an undescribed species of *Uropterygius*.

Fowler's (1938) record of *Lycodontis afer* from South Seymour (Baltra) Island is probably based on Herre's (1936, p. 44) listing of *Gymnothorax Junebris* (James E. Böhlke, personal communication, 13 August 1974). We have reidentified Herre's specimen (SU 24386) as *G. panamensis*. Other doubtful records and invalid species have recently been treated. Rosenblatt *et al.* (1972) corrected Herre's (1936) erroneous records of Indo-Pacific species said to be from the Galapagos. Herre's listing of *Gymnothorax chilospilus* and *G. undulatus* was based on small specimens of *Muraena lentiginosa*. Randall and McCosker (in press) placed *Lycodontis umbra* Fowler (1944) in the synonymy of *Gymnothorax panamensis* (Steindachner).

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KEY TO THE GALAPAGOS MURAENIDS

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|----|--|---|
| 1a | Dorsal and anal fins developed as skin-covered ridges originating just before caudal | 2 |
| 1b | Dorsal and anal fins skin-covered but distinct, beginning ahead of gill opening and just behind anus, respectively | 5 |

- 2a Tip of tail hard and pointed; posterior nostril closely associated with an enlarged interorbital pore, so that posterior nostril appears double; Gulf of California to Panama and Galapagos *Anarchias galapagensis* (Seale)
- 2b Tip of tail blunt, with a skin-covered caudal; posterior nostril not closely associated with an interorbital pore 3
- 3a Teeth blunt, molariform; body color dark brown to black, encircled by numerous, narrow white rings; Indo-west Pacific, oceanic islands of eastern Pacific and Gulf of California to Panama *Echidna zebra* (Shaw)
- 3b Teeth pointed; body color mottled but without definite rings 4
- 4a Head and trunk longer than tail; ground color light with dark mottling; posterior nostril tubular, located anterior to center of eye; Gulf of California (SIO 65-330) and Galapagos *Uropterygius polystictus* Myers & Wade
- 4b Head and trunk shorter than tail; ground color dark with rusty mottlings; posterior nostril with a raised rim, located behind center of eye; Gulf of California to Panama and Galapagos *Uropterygius necturus* (Jordan & Gilbert)
- 5a Teeth blunt, becoming molariform in adults; body color even brown to black with scattered white spots; anterior nostrils orange in life; Gulf of California to Peru and Galapagos *Echidna nocturna* (Cope)
- 5b Teeth pointed at all ages; coloration various, not as above 6
- 6a Posterior nostril tubular 7
- 6b Posterior nostril not tubular, at most with a raised rim 9
- 7a Dorsal and anal margins white; black spot at corner of mouth not preceded by white; body with three rows of large irregular yellow blotches and many scattered small white spots; teeth on shaft of vomer not depressible; Alijos Rocks, Baja California, to Peru and Galapagos *Muraena argus* (Steindachner)
- 7b Dorsal and anal margin not white, with at most a few white blotches; black spot at corner of mouth preceded by a white area on lower jaw; body either mostly plain or spotted, but without large yellow blotches; all vomerine teeth depressible 8
- 8a A large black spot, equal to 2.5 or more eye diameters, around gill opening; young with 5 or 6 series of small hour-glass shaped spots, adults speckled with numerous very small irregular spots on body and fins; Cape San Lucas, Mexico, to Peru and Galapagos *Muraena clepsydra* Gilbert
- 8b Black area surrounding gill opening not conspicuous or ringed with white, its diameter equal to 1.5 eye diameters or less; color not as above, either tan with rows of round to oblong yellow or white spots, or dark and reticulated with a few small white spots; Gulf of California to Peru and Galapagos *Muraena lentiginosa* Jenyns
- 9a Lower jaw curved, so that a gap is present and teeth are visible when mouth is closed 10
- 9b Lower jaw nearly straight so that there is no gap and the teeth are hidden when mouth is closed 11
- 10a Body coloration uniform brown to grey; pores along upper lip elongate slits with crenulate margins; Gulf of California (SIO 65-336) to Colombia and Galapagos *Enchelycore octaviana* (Myers & Wade)
- 10b Body coloration dark brown, head and throat overlain with numerous light spots, a series of large light blotches along sides; all head pores round; Galapagos and Japan *Enchelycore lichenosa* (Jordan & Snyder)

- 11a Body coloration white, profusely covered with dark brown speckling; vomerine teeth biserial, maxillary teeth uniserial; Indo-west Pacific and oceanic islands of eastern Pacific *Gymnothorax pictus* (Ahl)
- 11b Body background color various, if white not profusely speckled; vomerine teeth not in two equal rows, maxillary teeth uniserial or biserial 12
- 12a Dorsal origin about midway between occiput and gill opening; head pores ringed in white, a black ring around eye; outer series of teeth thickened, bent abruptly backward at tips, their posterior margins serrate; Gulf of California to Panama; Galapagos and Juan Fernandez and Easter Islands *Gymnothorax panamensis* (Steindachner)
- 12b Dorsal origin notably closer to occiput than gill opening; head pores not ringed in white, no dark ring around eye; teeth in jaws all conical, straight or evenly curved, their margins smooth 13
- 13a Teeth on maxillary in two rows, the outer row smaller than the inner; five longitudinal rows of teeth in the front of upper jaw; body ground color dark brown to black, overlain with a wavy, irregular mottling; Indo-west Pacific and oceanic islands of eastern Pacific *Gymnothorax buroensis* (Bleeker)
- 13b Maxillary teeth uniserial; three longitudinal rows of teeth in the front of upper jaw; body ground color brown to black or green, not overlain with a dark, irregular mottling 14
- 14a Body ground color dark brown to black, with numerous white spots; Panama to Colombia and Galapagos *Gymnothorax dovii* (Günther)
- 14b Body ground color brown to brownish green, usually plain although sometimes with a few white or yellow flecks, mostly on posterior half and dorsal fin; Gulf of California to Panama and Galapagos *Gymnothorax castaneus* Jordan & Gilbert

NEW RECORDS

Muraena clepsydra Gilbert.

This species is known from Cape San Lucas, Baja California, Mexico, to Panama. Galapagos specimens have come from Barrington (Santa Fe) Island (SIO 55-259; 970 mm; UCLA 55-314; 3, 82-305 mm.).

Gymnothorax buroensis (Bleeker).

A single specimen (SIO 74-103; 465 mm.) was collected at Darwin Bay, Tower (Genovesa) Island by M. Ancil. *Gymnothorax buroensis* is known from the Indo-west Pacific and Hawaii, and in the eastern Pacific from Clipperton and Cocos islands and nearshore localities in Costa Rica and Panama (Rosenblatt *et al.*, 1972).

Echidna zebra (Shaw).

The Galapagos record is based on an observation of this species by Gerard M. Wellington, Charles Birkeland, and Peter Glynn at Tower (Genovesa) Island during January, 1975 (Wellington, personal communication, 31 Jan. 1975). Although the specimen was not collected, its unmistakable appearance would preclude its misidentification.

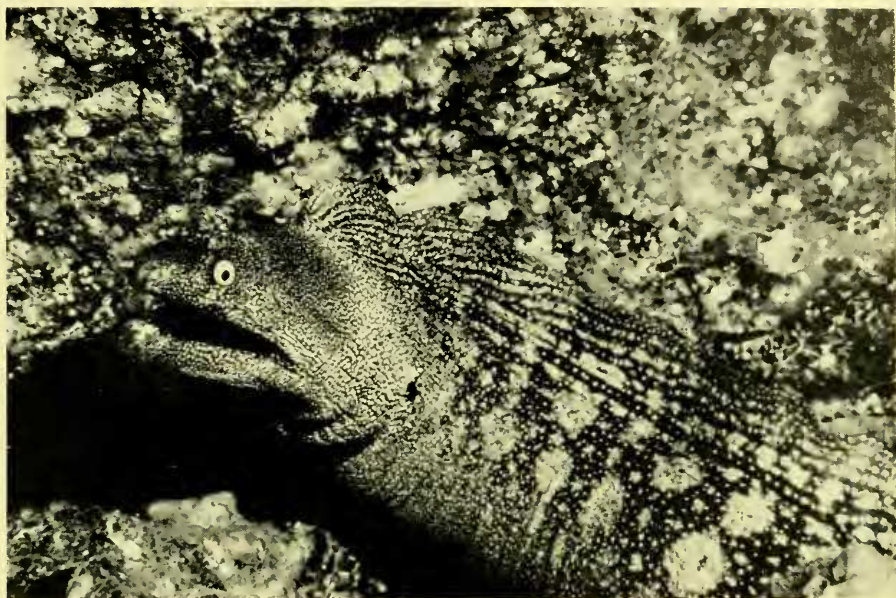


FIGURE 1. *Muraena argus*, photographed at Gordon Rocks, Galapagos Islands, in a cave at approximately 45 m. depth, by Carl Roessler.

***Muraena argus* (Steindachner).**

This species is known from Alijos Rocks, Baja California, Mexico to Peru (see discussion under *Muraena albigutta*, page 426). A Galapagos specimen was collected at James Bay, James (San Salvador) Island (UCLA 67-33, 900 mm.), and we have a photograph from Gordon Rocks (fig. 1).

***Uropterygius necturus* (Jordan & Gilbert).**

This species is known from the Gulf of California to Panama, the Revillagigedo and Clipperton islands, and has been taken at several Galapagos localities including Indefatigable (Santa Cruz) Island (UCLA 64-19, 230 mm.), Tower (Genovesa) Island (UCLA 67-35; 9, 174-232 mm.), and Charles (Santa Maria) Island (UCLA 67-43; 3, 220-280 mm.).

***Enchelycore lichenosa* (Jordan & Snyder).**

Aemasia lichenosa was described by Jordan and Snyder (1901) as the type species of a new genus on the basis of Japanese market specimens from Wakanoura (the holotype, SU 6480, now at CAS, 52 cm.) and Misaki (a paratype, USNM 49976, 55 cm.). Except for Randall and McCosker's (in press) synonymy of *Aemasia* with *Enchelycore*, this species, to our knowledge, has been mentioned only in Japanese faunal works. We were somewhat

surprised then, to discover four adult specimens of a hook-jawed moray that we have identified, by comparison with the type material, as this species. Galapagos specimens are from Punta Espinosa, Narborough (Fernandina) Island (UCLA 64-3, 70 cm.; UCLA 64-8, 76 cm.; ANSP 117435, 60 cm.; ANSP 109855, 63 cm.). We are unable to separate the Galapagos specimens from the Japanese type material on the basis of morphological characters, coloration, or dentition. The holotype has 148 vertebrae (56 preanal); Galapagos specimens ANSP 109855 and ANSP 117435 have 136 (57 preanal) and 142 (53 preanal) vertebrae, respectively.

The addition of *Enchelycore lichenosa* to the Galapagos' fauna represents the ninth Indo-Pacific muraenid species known from the eastern Pacific (see Rosenblatt *et al.*, 1972). It is curious that *E. lichenosa* has not been taken elsewhere in the Pacific.

IDENTITY OF INVALID GENERA AND SPECIES

Rabula Jordan & Davis.

Jordan and Davis (1891, pp. 589–590) erected the subgenus *Rabula* to include those species of *Gymnothorax* with a dorsal fin origin beginning over or behind the gill opening. They designated as type-species *Muraena aquae-dulcis* Cope 1872, on the basis of a specimen (USNM 6673) from San Diego, California or “probably . . . from farther south,” and Cope's description of the holotype. Fowler (1912) subsequently found their specimen to differ from Cope's species and, in a footnote which we quote, described it as a new species, *Rabula davisi*:

I may note that Jordan and Davis identify an eel from San Diego, Cal., with Cope's species, and as they do not explicitly designate Cope's fish the former must be taken as the type of their genus *Rabula*. Therefore, the *Gymnothorax aquae-dulcis* (nec *Muraena aquae-dulcis* Cope) Jordan and Davis requires a new specific name.

We examined the holotype of *R. davisi* and found it to be an aberrant specimen of *Gymnothorax mordax* (Ayres, 1859). The dorsal fin appears to arise in the mid-trunk region; however a radiograph (fig. 2) of the specimen clearly shows that the dorsal fin arises above the 4th vertebra, disappears above the 11th, then reappears above the 61st. The specimen has 145 total vertebrae with 64 before the anal fin, not differing significantly from combined data for 54 specimens of *Gymnothorax mordax* (K. McCleneghan, personal communication, and C. Clothier, unpublished data) with a range of 143–152 total vertebrae (\bar{x} = 147.8) and 61–67 preanal (\bar{x} = 65). The specimen also agrees with *G. mordax* in its coloration, dentition, and morphometry. *Rabula* thus becomes a synonym of *Gymnothorax* Bloch 1795.

Other morays currently referred to *Rabula* include *R. fuscomaculata*

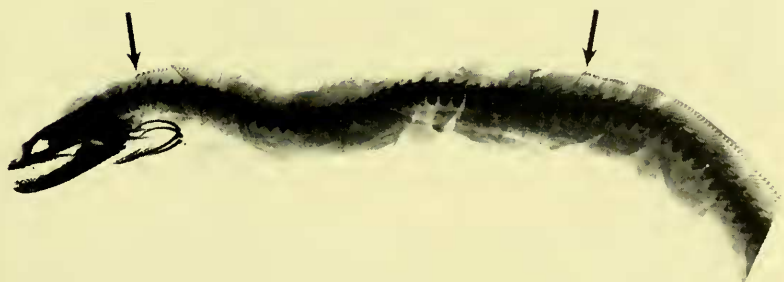


FIGURE 2. Radiograph of the head and trunk regions of the holotype of *Rabula davisi*. Arrows indicate dorsal fin origin above the 4th vertebra and reappearance above the 61st vertebra.

Schultz, *R. marshallensis* Schultz, and *R. acuta* (Parr). We have examined and radiographed specimens of '*fuscomaculata*' (CAS 31206) and '*marshallensis*' (CAS 31205) and, with the exception of the posterior dorsal fin origin, are unable to find characters which would allow their generic separation from *Gymnothorax*. We are hesitant to recognize them as generically distinct solely on the basis of their fin location.

***Sideria chlevastes* Jordan & Gilbert.**

Examination of the holotype (USNM 20385) of *Sideria chlevastes* has shown the taxon to be a junior synonym of *Gymnothorax rueppelliae* (McClelland), a wide-ranging Indo-Pacific and Hawaiian species. The two common Indo-Pacific species of *Gymnothorax* with conspicuous broad bands have been called *G. ruppeli* (an unjustified emendation of *rueppelliae*) and *G. petelli*, respectively, by most modern authors. Randall (1973, p. 174) has shown however, that both names apply to the same species, and that the former has priority. Thus '*petelli*' of authors becomes '*rueppelliae*', and '*rupelli*' of most authors is without a name. Moreover, '*reticularis* Bleeker' is not available, as suggested by Randall, since that represents a misidentification of *Gymnothorax reticularis* Bloch, a distinctly different species.

Jordan and Gilbert's (1883) terse description of *Sideria chlevastes* merely states "obtained at the Galapagos Islands by Captain Herendeen." A search at the National Museum of Natural History by the senior author for further information concerning the type specimen revealed only that it was entered into the catalog on 13 August 1877, with a listing only of the collector and

"Galapagos Islands." No other specimens accompanied it. In that no subsequent Galapagos specimens have appeared since Herendeen's, we suspect that the locality was in error. It was not uncommon at that time for whalers such as Herendeen to stop at Hawaii and other islands, often returning with specimens to be deposited at the USNM. In that manner, it is not unlikely that a locality error might have originated. The 220 mm. holotype has 135 vertebrae, 51 before the anus.

***Rabula rotchii* Clark.**

Clark's (1936) description is based on an abnormal specimen of *Echidna nocturna* (Cope, 1872) with a posterior dorsal insertion. The holotype (CAS 4964) in other proportions, coloration, and dentition fits *E. nocturna* well.

***Echidna chionostigma* Fowler.**

While preparing this study we examined the type specimens (ANSP 14519 and 14520) of *E. chionostigma* Fowler, 1912, "probably from the Gulf of California," and found them also to be referable to *Echidna nocturna* (Cope, 1872).

***Echidna scabra* Garman.**

Garman's (1899) type specimen (MCZ 28451) of *Echidna scabra*, from Cocos Island, is a juvenile of *Echidna nocturna* (Cope, 1872).

***Muraena acutis* Seale.**

Seale's (1917) type specimen (MCZ 3960) of *Muraena acutis*, from the Gulf of Panama, is clearly referable to *Echidna nocturna* (Cope, 1872).

***Gymnothorax thomsoni* Borodin.**

Borodin's (1928) feckless description but passable illustration of *G. thomsoni* clearly relates to an injured specimen of *Gymnothorax pictus* (Ahl, 1789), not *G. dovii* as suggested by Fowler (1938, p. 251).

***Gymnothorax arae* Borodin.**

Borodin's (1928) inadequate description of *G. arae* from Darwin Bay, Tower (Genovesa) Island does mention scattered white dots, indicating that *G. arae* is a junior synonym of *G. dovii* (Günther, 1870).

***Lycodontis xanthospilus* Fowler.**

Our examination of the holotype (ANSP 70026) of *L. xanthospilus* Fowler (1944) from James (San Salvador) Island revealed it to be a small specimen of *Muraena lentiginosa* Jenyns, 1842.

***Muraena insularum* Jordan & Davis.**

A study of an adequate series of *Muraena* from the Galapagos Islands leads us to the conclusion that *M. insularum* Jordan & Davis, 1891, described from a Chatham (San Cristobal) Island specimen, also is identical with *M. lentiginosa* Jenyns, 1842. Two extreme color forms may be segregated in the Galapagos material. One has a color pattern of light brown with darker reticulations which almost form bars. In this dark sort there are a few light spots, but these are restricted to the throat. The dark color pattern has been described and figured by Morrow (1957, p. 16) and described by Jordan and Davis in the original description of *M. insularum*. Extremes of this kind are purplish brown, with a few scattered white spots on the throat. In the other sort, the ground color is light brown and there are several series of white spots down the sides and on the fins. These spots tend to line up in rows. The spots are surrounded by dark brown areas which tend to coalesce to form an interlocking network. There is, however, a complete range of variation between these sorts. Further, Jenyns' description of *M. lentiginosa* seems to have been based on a specimen of the dark sort.

The difference mentioned by Jordan and Davis concerning the number of rows of teeth in the upper jaw is invalid, since in all the known eastern Pacific species of *Muraena* the inner row of enlarged teeth is lost with increasing size.

It is of interest that such variability in coloration is not found in mainland populations. All of a large number of mainland specimens are much like the light island types in coloration, except that the dark brown areas surrounding the light spots are less extensive and never coalesce. However, all of our specimens are from Panama north, and Morrow (1957) has reported a specimen of the dark type from Peru. This seems to indicate that the Peruvian and Galapagos populations are genetically different from the northern populations. It is, however, difficult to evaluate differences in variability, and we do not feel that specific or even subspecific differentiation is indicated.

***Muraena aquae-dulcis* Cope.**

Our examination of the Costa Rican type specimen (ANSP 14925) of *M. aquae-dulcis* Cope, 1872 indicates that it is a small and damaged specimen of *M. lentiginosa* Jenyns, 1842.

***Murenophis marmoreus* Valenciennes.**

Although no specimens of this species have been reported since its description (Valenciennes, 1846), the name continues to appear as a species of *Gymnothorax* (Jordan & Davis, 1891) or *Rabula* (Jordan & Evermann, 1896; Fowler, 1938). Jordan and Evermann considered it to be "a doubtful species, perhaps based on *Muraena lentiginosa*." The illustration of the holotype leaves little doubt that this surmise is correct. The coloration (see discussion under *Muraena*

insularum) is diagnostic. The indication in the figure of a dorsal origin behind the gill opening is likely an error and Valenciennes's description of the posterior nostril as a slit beneath the eye applies to no known muraenid.

Muraena albigutta Hildebrand.

Hildebrand (1946), in describing *Muraena albigutta* from Peru, was apparently unaware of Steindachner's (1870) description of *Muraena argus* from Altata, Sinaloa, Mexico. Our material from the Gulf of California (SIO 60-1; UCLA 56-68) agrees well with Steindachner's description. We have compared the holotype of *M. albigutta* (USNM 127840) with a specimen from Guaymas, Sonora, Mexico. They agree, particularly in the distinctive coloration and in that the teeth on the shaft of the vomer are not depressible. *Muraena argus* is now known from Alijos Rocks, Baja California, Mexico (SIO 74-104); the Gulf of California; Isla La Plata, Ecuador (UCLA 53-419); Lobos de Afuera, Peru; and the Galapagos.

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